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(71) Applicant: **adidas International B.V.**
1062 KR Amsterdam (NL)

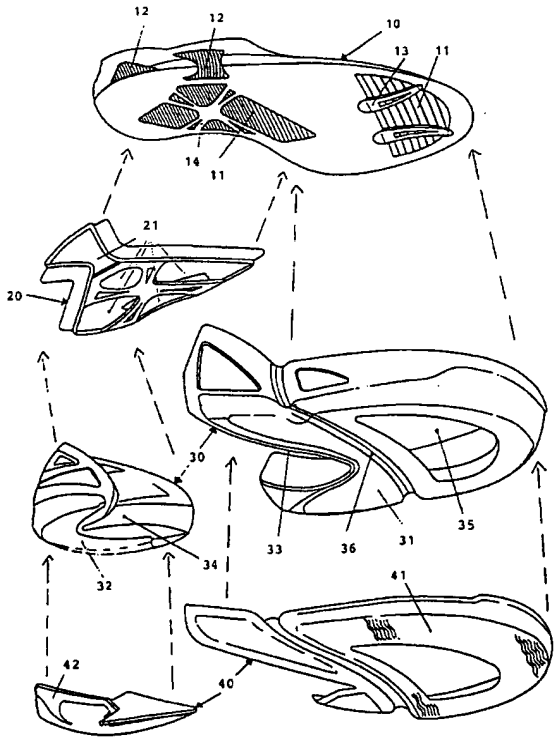
(72) Inventors:
- **Berger, Christoph**
  91349 Egloffstein (DE)
- **Manz, Gerd Rainer**
  91085 Weisendorf (DE)

(74) Representative: **Hess, Peter K., Dipl.-Phys.**
Patent- und Rechtsanwälte
Bardehle - Pagenberg - Dost
Altenburg - Geissler -Isenbruck
Galileiplatz 1
81679 München (DE)

(54) Shoe

(57) The present invention relates to a shoe, in particular a sports shoe with an insole layer (1) with first openings (2, 3), a support layer (10) with second openings (11, 12) which partially overlap the first openings (2, 3) and an outsole layer (30) with at least one third opening (33, 34, 35) which at least partially overlaps the second openings (11, 12).

FIG.1



EP 1 197 157 A1

Description

[0001] The present invention relates to a shoe, in particular a sports shoe.

1. The prior art

[0002] The technical development of shoes, in particular sport shoes has considerably advanced over the last years. Nowadays shoe constructions are available which are exactly adapted to the mechanical stress on the foot arising under different kinds of sports and which therefore provide a high degree of functionality and wearing comfort.

[0003] In spite of these important improvements, however, it was up to now not possible to manufacture shoes which in addition to the necessary damping and support for the foot also provide a comfortable climate for the foot. On the contrary, in particular the use of the foamed plastic materials common in modem sports shoes prevents heat and humidity being sufficiently transported away from the foot to efficiently avoid a hot feeling, unpleasant odor or the risk of diseases of the foot. This is in the case of sports shoes a severe problem, since due to the increased body activity during sport more heat and humidity arises in the foot area within the shoe.

[0004] For this reason there are different approaches in the prior art to obtain a sufficient ventilation and a fast removal of sweat.

[0005] Already the Swiss patent 198 691 discloses an insole wherein a leather sole provided with holes is arranged as a top layer on a frame-like supporting layer. Thus, the skin is to be surrounded by air from all sides, in order to account for the breathing requirements of the footsole. A similar construction is disclosed in the GB 2 315 010.

[0006] A disadvantage, however, is that no exchange takes place between the volume of air arranged below the foot sole and the surrounding air with the result that humidity and bacteria can accumulate there.

[0007] A more advanced approach of the prior art is to connect an air volume provided below the insole with the outside air by means of lateral openings. The repeated compression of the shoe sole (as a result of the action of the foot whilst running / walking) causes the warm air and humidity from the air volume inside the shoe to be pumped with each step to the outside assuring the necessary air exchange and to transport humidity away. Examples for the realization of this idea can be found in the DE 121 957, the US 5,035,068, the US 4,837,948 and the US 5,655,314.

[0008] A further construction of this type is known from the DE 32 25 451. The shoe comprises an insole with openings, an intermediate sole or mid-sole with openings and an outsole closed to the outside.

[0009] It is, however, a problem of these constructions, that either the pumping action provided by the compression of the sole is much too weak to assure a substantial exchange of air via the lateral openings, which are several centimeters away, so that the warm air and the humidity is only slightly moved back and forth without actually leaving the volume below the insole, or that the recess arranged below the insole (containing the volume of air) is so big that too soft a shoe is created, which is mechanically unstable.

[0010] The additional arrangement of partly closeable openings on the upper side of the shoe, as it is known from further documents of the prior art, for example the US 4,693,021, the US 5,357,689 and the US 5,551,172, does not have any influence on these disadvantages, since the heat and humidity dispensed by the foot is predominantly arising in the foot sole area so that openings on the upper side of the shoe cannot contribute to the ventilation.

[0011] As a result, the arrangement of ventilation openings on the side as well as on the upper side does not lead to a shoe which provides a comfortable and healthy foot climate.

[0012] A different approach is disclosed in the US 4,290,211. Here, the outsole is perforated by a plurality of conically tapered holes. Additionally, an insole can be provided having also perforations which exactly coincide with the openings of the outsole.

[0013] Although a sufficient ventilation is generally possible by this direct vertical connection from the foot sole to the outside, the through-holes lead to a reduced mechanical stability of the sole so that only a few openings can be provided. This, however, reduces again the desired ventilation effect. As a result, such a simple perforation of the shoe sole has not become popular, in particular in the case of sports shoes.

[0014] With the introduction of so-called climate membranes, as for example marketed under the trademark GORE-TEX®, constructions have been suggested - for example in the WO 97/28711 and the EP 0 956 789 - wherein the holes in the outsole are covered by a breathable membrane. Although this leads to an improved watertightness of the shoe, the above described disadvantages concerning the stability of the shoe are not overcome, but worsened, since even with a breathable membrane more through-holes in the sole are necessary to assure a sufficient ventilation of the foot sole.

[0015] The WO 99/66812, the EP 0 960 579 and the US 5,983,524, finally, disclose combinations of the described approaches, however, without removing the respective disadvantages. The five-layer system disclosed in the US 5,983,525 consists of an outsole, a membrane, a protecting layer, a filling layer and an insole with isolated arranged perforations in the respective layers. This system is far too dense for an effective ventilation of the sole area, even if breathing active materials are used.

[0016] It is therefore the problem of the present invention to provide a shoe, in particular a sports shoe, which overcomes the discussed disadvantages of the prior art by meeting on the one hand the requirements of the me-

chanical properties of modern shoes, in particular sports shoes, and by sufficiently transporting on the other hand heat and humidity away from the foot, in order to assure a comfortable and healthy foot climate.

2. Summary of the invention

[0017] The present invention relates to a shoe, in particular a sports shoe, with an insole layer with first openings, a support layer with second openings partly overlapping the first openings and an outsole layer with at least a third opening at least partly overlapping the second openings.

[0018] In contrast to the prior art, the air exchange is according to the invention neither provided through lateral openings nor via vertical through-holes in the shoe sole. Instead, the humidity and the warm air passes at first through the first openings of the insole layer down to the support layer. There, depending on the extent of overlapping, which can be different for sports shoes for different purposes, fractions of the humidity or the warm air must first perform a small lateral movement, before the outsole layer is reached through the second openings in the support layer. In a similar way the humidity and the warm air passes through the third opening of the outsole layer, which at least partly overlaps the second openings of the support layer, and thus reaches the outside.

[0019] By the different arrangement in the three layers, the openings in which only partially overlap according to the invention, a substantially greater number of openings can be arranged in the insole layer than in the prior art without endangering the mechanical stability of the shoe. As a result, the heat and humidity is directly removed from the foot sole much more quickly and the foot climate is thus improved.

[0020] The three part construction according to the invention allows further that the openings in the support layer can be arranged such that the general stability of the shoe is not negatively influenced by its particular climate properties. Openings of the outsole layer, finally, can to a large extent be distributed independently from the two other layers so that the high requirements on modern shoes, in particular sports shoes, with respect to the damping of the impact forces and the traction on the ground can be fulfilled in the same way as in conventional shoes. Further, it is possible to design the openings such that the ventilation of the foot by the passing air is maximized.

[0021] The first openings are preferably distributed over the complete insole layer and are preferably circular. Thus, a pumping effect is achieved under the repeated compression of the insole layer which transports the hot and humid air away from the foot sole down to the support layer.

[0022] In order to avoid an unpleasant pressure distribution on the foot sole and a premature material fatigue during ground contact with the heel or push-off with the forefoot part (during which time the mechanical loading on the shoe is at its greatest), the first openings of the insole layer have in the area of the ball of the foot and the heel preferably a smaller diameter than in the other parts of the sole.

[0023] The first openings are preferably interconnected in the insole layer by channels. Thus, when humidity or hot air reaches the support layer through a first opening in the insole layer and it does not directly hit upon an overlapping second opening in the support layer, the channels facilitate the horizontal "diffusion" inside the sole to the nearest second opening in the support layer. This process is supported by the repeated compression of the insole layer, which causes also here a pumping action. In contrast to the lateral ventilation in the prior art (see above) the hot and humid air only needs to perform a lateral movement of a few millimeters, before the nearest second opening in the support layer is reached.

[0024] Depending on the mechanical loads the shoe is subjected to and the degree of the desired flexibility, it is possible to provide a support layer, which does not extend over the complete sole area but covers only parts thereof. Thus, the ventilation of the interior is further improved.

[0025] Preferably, the support layer is compression-proof and controls the deformations of the shoe. Thus, it provides in a way similar to a skeleton a frame for the complete shoe with its plurality of openings and recesses. Preferably, the support layer is continuous below the heel and the ball part to permanently withstand the particularly high mechanical loadings on the shoe in these parts of the foot sole during the repeated ground contact and push-off. The second openings in the support layer are preferably provided in the toe part and/or in the part of the arch, where the highest density of sweat pores of the foot can be found, to further downwardly guide the hot and humid air arriving through the first openings in the insole layer.

[0026] The openings in the support layer are preferably shaped like a grille to achieve the lowest resistance for the humid and hot air and simultaneously the greatest stability. In the area of the arch the support layer comprises an additional support element connecting the forefoot part and the rearfoot part like a frame. The support element supports the arch of the foot and controls torsional movements of the forefoot part with respect to the rearfoot part. The outsole layer comprises preferably a forefoot part and a separate rearfoot part. Below the ball and/or the heel the outsole layer is preferably continuous to selectively control the damping properties of the shoe and to provide the necessary lateral and medial support for the foot.

[0027] Preferably, at least one third opening is arranged in the toe part of the outsole layer and/or at least one third opening in the part of the arch of the outsole layer thus overlapping with corresponding second openings in the support layer.

[0028] The outsole layer comprises preferably a cush-

ioning layer and a tread layer. The cushioning layer determines by its compressibility essentially the damping properties of the shoe, whereas the tread layer provides the desired traction properties of the shoe. It can be seen that in contrast to the described prior art the damping properties of the shoe can to a large extent be designed independently from the climate properties of the shoe. However, if desired, the damping or cushioning properties of the shoe can also be exclusively provided by the insole layer. In this case the outsole layer only serves for assuring the necessary traction properties.

[0029] If the shoe is to have an improved watertightness, a membrane made out of a breathable but watertight material can be arranged preferably between the support layer and the insole layer.

[0030] In order to further improve the climate properties of the shoe according to the invention, preferably net-like protection elements are used for the selective reinforcement of parts of the shoe upper. By replacing the common denser materials in this region having typically a high thermally isolating effect, also here an improved ventilation of the interior of the shoe is achieved.

[0031] Further developments are the subject matter of further dependent claims.

3. Short description of the drawing

[0032] In the following detailed description presently preferred embodiments of the present invention are described with reference to the drawings which show:

Fig. 1: An exploded view diagram of the elements of the support layer and the outsole layer according to a preferred embodiment;

Fig. 2: a view of the insole layer according to the invention;

Fig. 3: a view of the assembled support layer and the outsole layer from below;

Fig. 4: a side view of the assembled support layer and the outsole layer of Fig. 3;

Figs. 5 to 8: a schematic representation of alternative embodiments of the support layer and the outsole layer;

Fig. 9: a representation of the unfolded net-like protection element for a particularly preferred embodiment;

Fig. 10: a side view of an embodiment, wherein the net-like cushioning element of Fig. 9 is used for supporting the ankle joint.

Fig. 11: comparison of two graphs showing the humidity of a foot climate-measuring-sock in the interior of a shoe made in accordance with the invention (Fig. 11a) and in the interior of a reference shoe (Fig. 11b).

4. Detailed description of the invention

[0033] In the following a preferred embodiment of the shoe according to the invention is discussed as well as a selection of preferred modifications with reference to a sports shoe. However, it is to be understood that the present concept of a shoe can also be used to improve the foot climate of an ordinary shoe.

[0034] The shoe according to the invention comprises with reference to Figures 1 and 2 at least three layers which are partly comprised of several function specific components:

[0035] Below an insole layer 1, shown in Fig. 2, a support layer 10 is arranged. The support layer 10 is preferably reinforced from below by an additional support element 20. The upper of the shoe (not shown) can be attached to the edge of the support layer 10 by gluing, stitching or other suitable techniques.

[0036] Below the support layer 10 and the support element 20 an outsole layer 30 is arranged comprising in the shown preferred embodiment illustrated in Fig. 1 a forefoot part 31 and a rearfoot part 32. For improving the traction, an additional tread layer 40 is preferably provided directly below the outsole layer 30 which comprises corresponding to the forefoot part 31 and the rearfoot part 32 of the outsole layer 30 a front part 41 and a rear part 42.

[0037] If the elements shown in Fig. 1 of the shoe according to the invention are assembled, as indicated by the dashed arrows in Fig. 1, the sole ensemble shown in Figs. 3 and 4 is obtained (for the sake of clarity the tread layer 40 is not shown). The upper of the shoe (not shown) is attached to this sole construction.

[0038] The insole layer 1 (cf. Fig. 2) comprises a plurality of preferably circularly shaped openings 2, 3 which are preferably distributed over its complete area. In order to avoid an excessive local pressure on the foot sole and a simultaneous good ventilation, the holes 2 of the insole layer 1 are preferably smaller in the heel part and in the part corresponding with the ball of the foot. Here, the preferred diameter is only approx. 2 to 3 mm, whereas the hole in the remaining parts of the insole layer have a greater diameter (preferably approx. 4 mm) to optimize the permeability of the insole layer for air and humidity.

[0039] The insole layer 1 is preferably made out of a comparatively soft material, for example PU (polyurethane) or EVA (ethylene-vinylen-acetate). By the repeated compression of the insole layer 1 due to the mechanical loading of the shoe during ground contact, a pumping action is caused, which quickly transports the humidity dispensed from the footsole down to the sup-

port layer 10.

[0040] The openings 2, 3 are preferably interconnected on the lower side of the insole layer 1 by a plurality of channels 4, 5. Whereas most of the greater holes 3 are connected to the respective next holes 3 only by a single channel 5, the smaller openings 2 are preferably interconnected by a grid-like net of crossing channels 4.

[0041] If in the case of high body activity, for example during a basketball game, hot and humid air develops below the foot sole in the interior of the shoe, it is transported through the openings 2, 3 down to the support layer 10. The network of channels 4, 5 arranged on the lower side of the insole layer 1 allows a fast horizontal "diffusion" of the humidity to the adjacent opening in the support layer 10. This diffusion is facilitated by the repeated compression of the channels 4, 5 on the lower side on the insole layer 1 which therefore act as small minipumps.

[0042] Generally, the channels 4, 5 can be arranged on the top side or the bottom side of the insole layer 1 or be integrated into this component. However, it was found that in order to avoid excessive friction between the foot sole and the insole layer 1 and for reasons associated with the manufacture of the insole layer an arrangement on the bottom side is preferred.

[0043] The support layer 10 forms together with the preferred additional support element 20 a frame or chassis around which the shoe is built. It determines therefore to a large extent the mechanical properties of the shoe according to the invention, i.e. the response to the loads arising during the particular sport.

[0044] As can be seen in the upper part of Fig. 1, the support layer 10 has in the forefoot part an essentially planar shape, whereas it encompasses preferably three-dimensionally the heel of the foot for providing support. Preferably, a plurality of openings 11 are arranged in the toe area and below the arch. Two additional longitudinal supports 13 reinforce the stability of the support layer 10 in the toe area.

[0045] Although the openings 11, 12, shown in the preferred embodiment of Fig. 1, are grill-shaped, a support layer 10 with circular holes or the like can also be used. The distribution of the openings 11, 12 takes into account the mechanical requirements of the support layer, so that preferably no openings are provided in the heel part and the part corresponding with the ball of the foot, since here a high degree of support must be provided for the foot, in order to avoid an excessive pronation or supination of the foot.

[0046] As can be seen in Fig. 1, also the lateral parts of the support layer 10 encompassing the foot are provided with openings 12 to contribute also here to an improved ventilation of the interior of the shoe.

[0047] When the insole layer 1 is arranged on top of the support layer 10, the hot and humid air coming down through the openings 2 and 3 can pass through the openings 11, 12 in the support layer 10. In the toe part and in the region of the arch the majority of the openings 2 and 3 directly overlap with the openings 11, 12 of the support layer 10. The humidity developing in the heel and ball part is, on the contrary, at first "pumped" through the channels 4, 5 along the lower side of the insole layer 1, i.e. along the upper side of the support layer 10, until the closest opening 11 or 12 in the support layer 10 is reached.

[0048] In order to permanently fulfill the described function as a mechanical frame or chassis for the shoe, the support layer 10 is preferably made out of compression-proof plastic materials as for example the material sold under the trade name Pebax®. This material has the advantage that it withstands the mechanical loading arising during contact of the shoe with the ground and has on the other hand the required flexibility not to hinder the movements of the foot, as for example during the rolling-off and pushing-off phase of the gait cycle . However, other materials are also conceivable, as for example Polyamide or TPU as along as the support layer is sufficiently compression-proof, stiff and flexible (depending on the kind of sport the shoe is designed for).

[0049] For reinforcing the support layer 10, an additional support element 20 is arranged in the area of the arch of the foot. The support element 20 is an open frame construction with a plurality of openings 21 which preferably correspond to the openings 11, 12 and the struts 14 of the support layer 10. The support element 20 determines the resistance of the sole ensemble to foot movements, for example torsional movements of the forefoot part with respect to the rearfoot part, and controls the longitudinal stiffness of the shoe. Depending on the kind of sport different embodiments of the support element 20 will be used, as schematically indicated in Figs. 5 to 8. Preferred materials for the support elements are for example thermoplastic polyurethane elastomers (TPU), Pebax® or Polyamide. The additional support element 20 can consist of the same material as the support layer 10.

[0050] Although in the preferred embodiment shown in Fig. 1 the support layer 10 and the support element 20 are shown as separate components of the sole ensemble according to the invention, also an integrated alternative is conceivable, where the two components 10, 20 are produced as an integral component, for example by dual injection molding.

[0051] The outsole layer 30 is arranged below the supporting layer 10 and the additional support element 20. In the preferred embodiment shown in Fig. 1 the outsole layer 30 comprises a forefoot part 31 and a separate rearfoot part 32. Thus, the weight of the shoe is reduced due to the absence of outsole material in the foot arch. Figs. 5 to 8 show schematically alternative embodiments of the outsole layer 30. In the case of sports such as tennis requiring a higher degree of lateral stability, for example due to strong lateral loads, preferably the embodiment shown in Fig. 5 will be used.

[0052] The outsole layer 30 determines by its arrangement and the used materials the damping proper-

ties of the shoe. Preferred are foamed materials, as for example PUR, EVA and elastomeric materials which are during the course of their manufacture subjected to a strong compression set, so that they permanently keep their elastic damping properties even under high mechanical loading.

[0053] In the case of sports with high lateral load, as for example basket ball, the outsole layer 30 can additionally extend upwards over the rim of the sole ensemble according to the invention (cf. Fig. 4) and thereby cushion against lateral ground contacts. If necessary, the flexibility of the outsole layer 30 can be improved by strategically positioning grooves 36 in the outsole layer 3, for example to facilitate an easier rolling-off phase of the gait cycle.

[0054] The large recesses or openings 33, 34, 35 in the outsole layer 30 facilitate - to a large extent independently from the damping properties of the outsole layer 30 - the dispersion of the hot and humid air from the interior of the shoe via the openings 11, 12 in the support layer 10 to the surrounding air. The openings 33, 34, 35 are preferably arranged such that they correspond exactly with the openings 11, 12 of the supporting layer 10.

[0055] As a result of the thickness of the outsole layer 30 (preferably 0.5 to 2 cm) the openings 11, 12 of the supporting layer 10 are not in direct contact with the ground. Accordingly this prevents humidity easily entering the interior of the shoe. If the sport shoe is not exclusively to be used for indoor sports (i.e. also for outdoor sports), then a breathable membrane (not shown) can be provided for a complete watertightness, which is preferably arranged between the support layer 10 and the insole layer 1. Thus, the grill-like openings 11, 12 of the support layer 10 protect the membrane against damage from below. In contrast to the prior art, enough openings are arranged on top and below the membrane in the shoe according to the invention so that the breathing properties of the membrane become effective without endangering the overall stability of the shoe. The membrane further prevents that stones or dirt enters the interior of the shoe, which may close the openings thereby deteriorating the ventilation properties of the shoe according to the invention.

[0056] The traction properties of the shoe according to the invention are preferably determined by an additional tread layer 40 which is arranged below the outsole layer 30. Depending on the field of use different materials will be used, as for example TPU or suitable rubber mixtures assuring a high abrasion resistance and providing simultaneously a good traction on the respective ground. The shape of the tread layer 40 corresponds preferably to the outsole layer 30 so that the ventilation properties of the shoe according to the invention are not influenced by the function specific selection of the suitable tread layer 40. As well as the outsole layer 30, the tread layer 40 can extend sideways over the rim of the sole ensemble to assure a good grip also during a lateral ground contact of the foot.

[0057] Sports shoes for sports with many jumps and frequent changes of direction, as for example basketball, extend typically upwards over the ankle joint to support this joint against the arising stress and to protect it against injuries. In a preferred embodiment, the shoe according to the invention therefore comprises a flexible net-like cushioning element 60 which is shown in Fig. 9 in an unfolded position and in Fig. 10 in its position around the heel part of the shoe. In the finished shoe this element is covered by a suitable air permeable fabric. Alternatively, the protection element can be directly three-dimensionally shaped, for example by injection molding or other suitable techniques.

[0058] The protection element 60 is made out of a flexible material, for example EVA or a material based on a silicone elastomer. Conceivable are also soft thermoplastic materials or a PU. The protection element comprises a plurality of openings 61 and improves thus, compared to common foamed materials, the air permeability of this part of the shoe. The dimensions of the openings 61 are preferably in the range of a few millimeters up to approximately 1 cm. The shape of the openings is arbitrary. Apart from the quadratic holes 61 illustrated in Fig. 9 and 10, circular or elliptic shapes are also conceivable. Independently from the shape a good support and protection function for the ankle joint is assured by the cushioning element according to the invention, in spite of the substantially improved ventilation of the interior of the foot at the heel part.

[0059] Similar cushioning elements can also be used in other parts of the upper (not shown), for example in the region of the instep to avoid excessive pressure by the lacing system of the shoe (laces, Velcro ®, fasteners etc.) without reducing the air permeability of the upper.

[0060] The climate properties of the described shoe according to the invention can be further improved by combining it with a special sock. The sock forms together with the shoe an overall system which determines the thermophysiological conditions the foot is subjected to. These conditions are defined by the heat and steam transmission resistances, the steam or water absorption /emission and the friction forces of the surfaces of the sock and the shoe.

[0061] A preferred sock to be used in combination with the described shoe comprises a 2-layer mesh having a first inside layer with good diffusion properties, so that the sweat generated by the foot is immediately transferred away from the skin to the second outer layer, for example by capillary wicking. The outside layer of the sock has preferably good absorption properties so that it can act as an intermediate storage for the humidity before it is transported to the ambient air through the openings in the layers of the shoe according to the invention. These particular properties of the sock can be achieved by using synthetic fiber materials as they are for example available under the trade names Polycolon® from the company Schöller, Dacron® from the

company DuPont or Rhoa®-Sport from the company Rhodia.

[0062] The substantially improved ventilation of the interior of the described shoe according to the invention compared to known shoes is impressively illustrated by the measurements shown in Figs. 11a and 11b. Using a foot climate measuring sock it was possible to determine, how fast humidity developing in the interior of the shoe is transported to the outside through the sole and the upper according to the invention.

[0063] A foot climate measuring sock is a cotton or polyester sock provided with capacitive sensors for measuring humidity and additional sensors for measuring the temperature. Since the sensors are very thin, they are not felt by the wearer of the sock. By means of measuring electronics the received data are read into a personal computer and analyzed.

[0064] Fig. 11a shows the result of a measurement taken during 25 minutes cycling on a tread mill with a shoe according to the invention. The increase of the humidity in the interior of the shoe is reflected by the increasing voltage plotted along the Y-axis. A slow increase from approx. 170 mV to approx. 400 mV (i.e. an increase of of approx. 330 mV) can be observed.

[0065] Fig. 11b shows the reference experiment of approx. 25 minutes cycling on a tread mill with a normal shoe. As can be seen, the voltage, which is proportional to the humidity in the interior, rises in this case from approximately 150 mV to almost 800 mV (note the different scaling), i.e. it rises by approximately 650 mV. Therefore, the shoe according to the invention reduces the increase in humidity in the interior of the shoe by almost 100% with respect to known shoes. This result corresponds to reports by test persons who noticed the considerably improved foot climate properties of the shoe according to the invention compared to known designs.

Claims

1. Shoe, in particular sports shoe, comprising:

   a. an insole layer (1) with first openings (2, 3);

   b. a support layer (10) with second openings (11, 12) which partially overlap the first openings (2, 3); and

   c. an outsole layer (30) with at least one third opening (33, 34, 35) which at least partly overlaps the second openings (11, 12).

2. Shoe according to claim 1, wherein the first openings (2, 3) are distributed over the complete insole layer (1).

3. Shoe according to claim 1 or 2, wherein the first openings (2, 3) are circularly shaped.

4. Shoe according to one of the preceding claims, wherein the first openings (2) of the insole layer have in the region of the ball and the heel a smaller diameter than in the other parts of the insole layer (1).

5. Shoe according to one of the claims 1 to 4, wherein the first openings (2, 3) in the insole layer (1) are connected to each other by channels (4, 5).

6. Shoe according to claim 5, wherein the channels (4, 5) are arranged on the bottom side of the insole layer (1).

7. Shoe according to one of the claims 1 to 6, wherein the support layer (10) is a compression resistant semi-rigid chassis.

8. Shoe according to claim 7 wherein the support layer (10) controls the deformation properties of the shoe

9. Shoe according to claim 8, wherein the support layer (10) is continuous below the heel and the ball part.

10. Shoe according to claim 9, wherein the support layer (10) comprises second openings (11, 12) in the toe region and/or in the region of the arch of the foot.

11. Shoe according to one of the claims 7 to 10, wherein the second openings (11, 12) are shaped like a grill.

12. Shoe according to one of the claims 7 to 11, wherein the support layer (10) comprises in the region of the arch of the foot an additional support element (20) interconnecting the forefoot part and the rearfoot part like a frame.

13. Shoe according to claim 12, wherein the support layer (10) and/or the support element (20) sideways encompasses the foot in the region of the arch of the foot and/or the heel.

14. Shoe according to one of the claims 1 to 13, wherein the outsole layer (30) comprises a forefoot part (31) and a separate rearfoot part (32).

15. Shoe according to one of the preceding claims, wherein the outsole layer (30) is continuous below the ball and/or the heel.

16. Shoe according to one of the preceding claims, wherein at least one third opening (35) is arranged in the toe part and/or at least one third opening (33, 34) in the region of the arch of the foot.

17. Shoe according to one of the preceding claims, wherein the outsole layer (30) sideways encom-

passes the heel and/or the forefoot part.

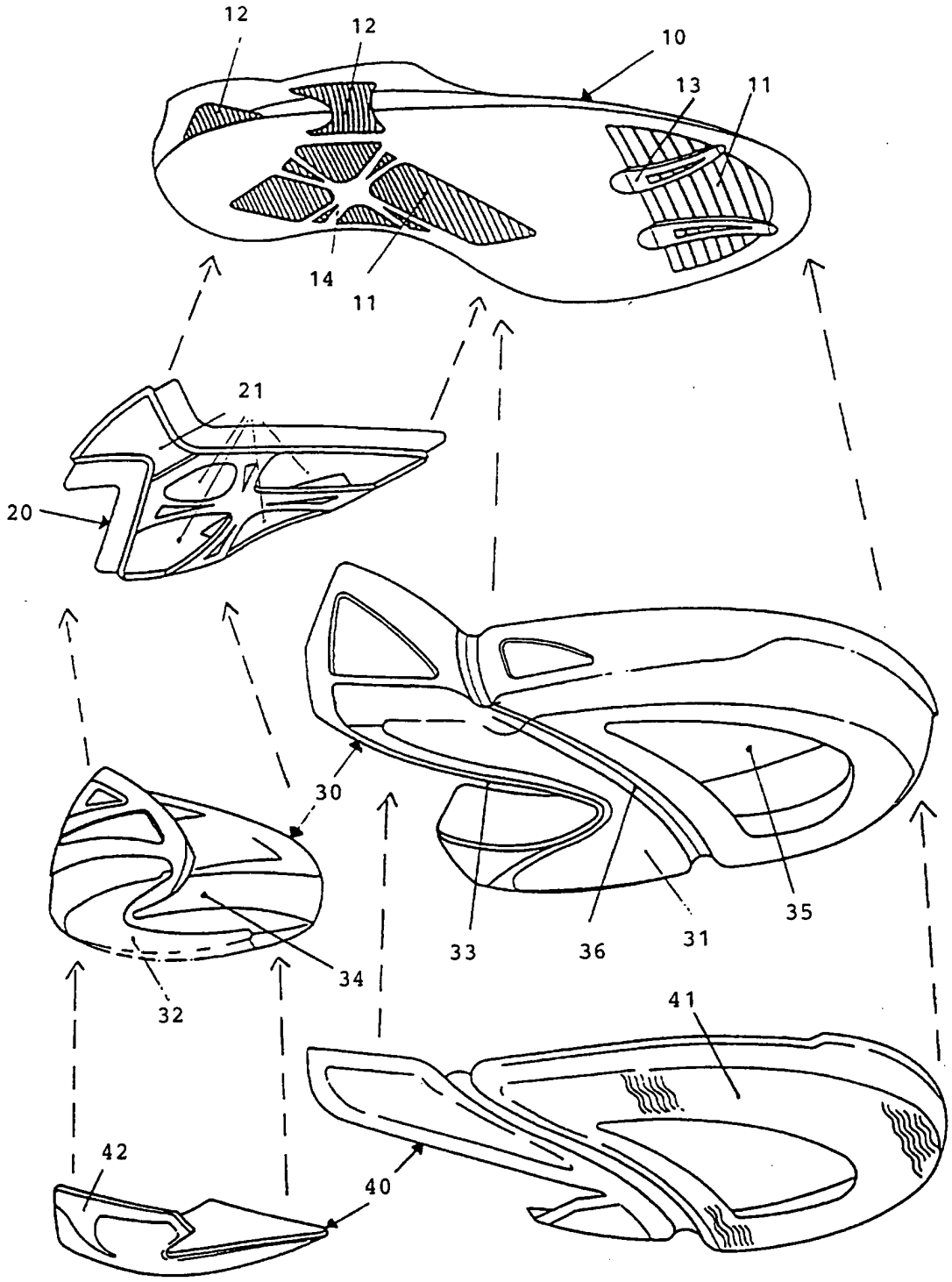
18. Shoe according to one of the preceding claims, wherein the outsole layer (30) comprises a cushioning layer (30) and a tread layer (40).

19. Shoe according to one of the preceding claims, wherein a membrane is arranged between the support layer (10) and the insole layer (1).

20. Shoe according to one of the preceding claims, further comprising a flexible net-like protection element (60) for the selective reinforcement of parts of the upper.

21. Shoe according to claim 20, wherein the net-like protection element (60) is arranged on the medial and/or the lateral side of the ankle joint.

FIG.1



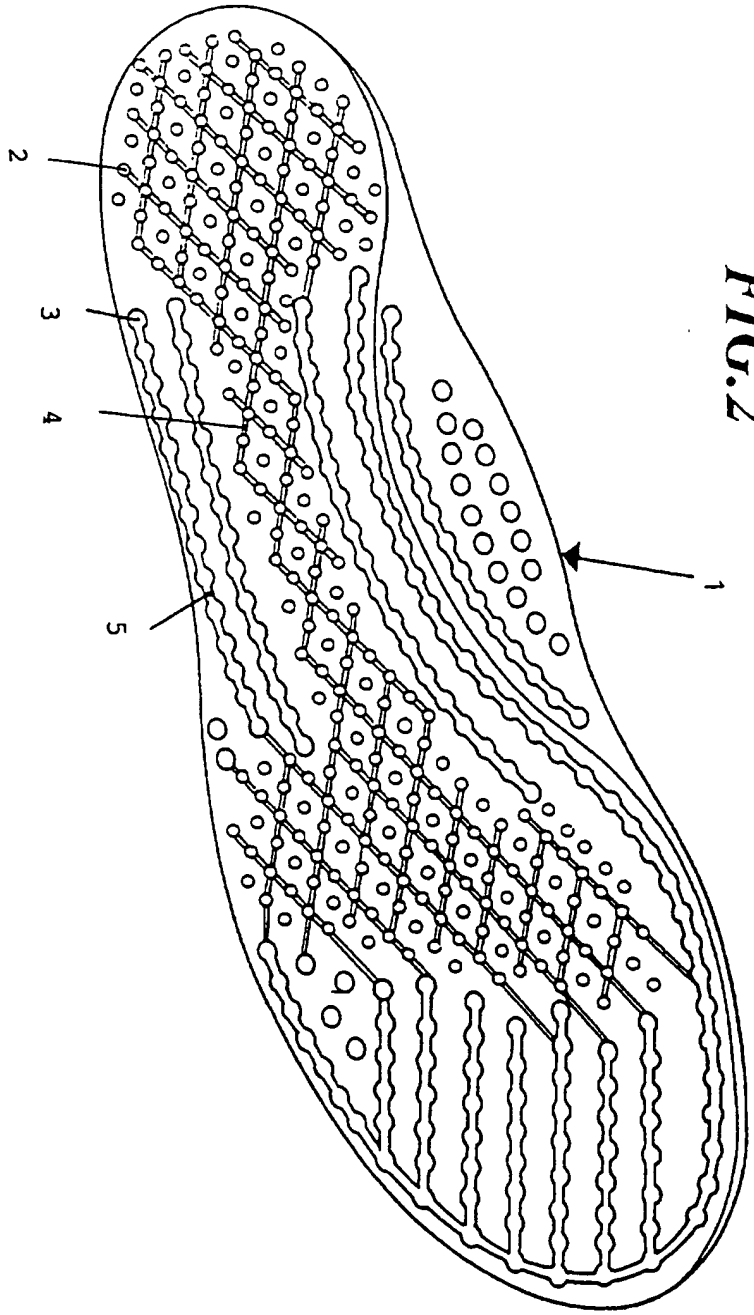


FIG.2

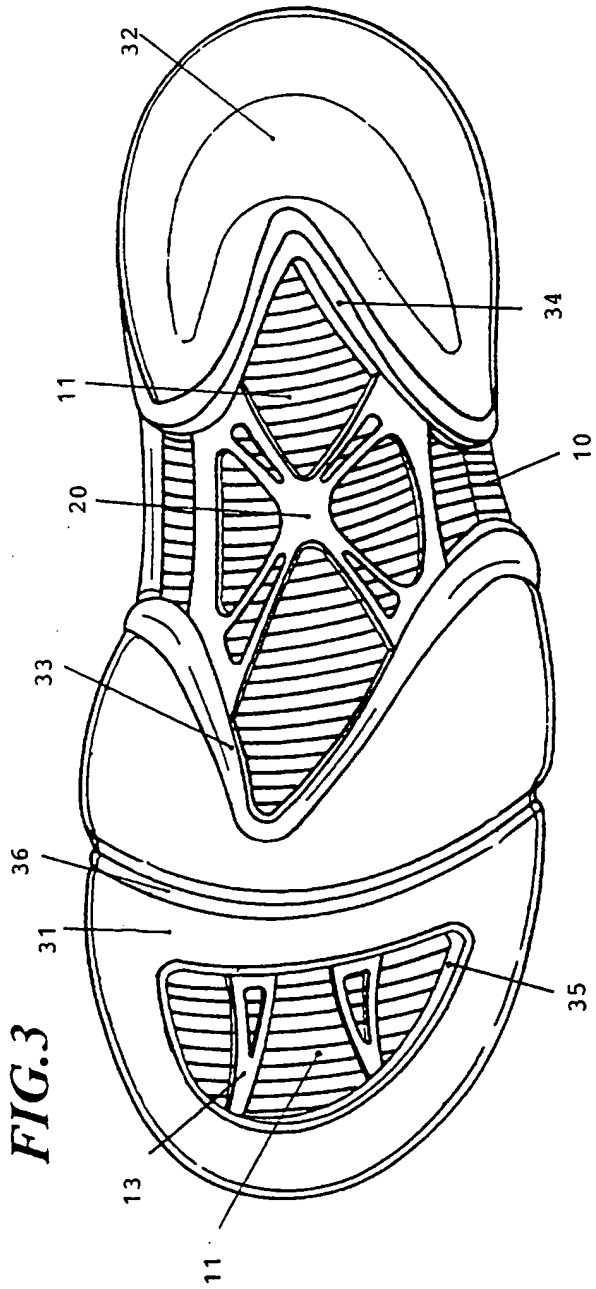


FIG.3

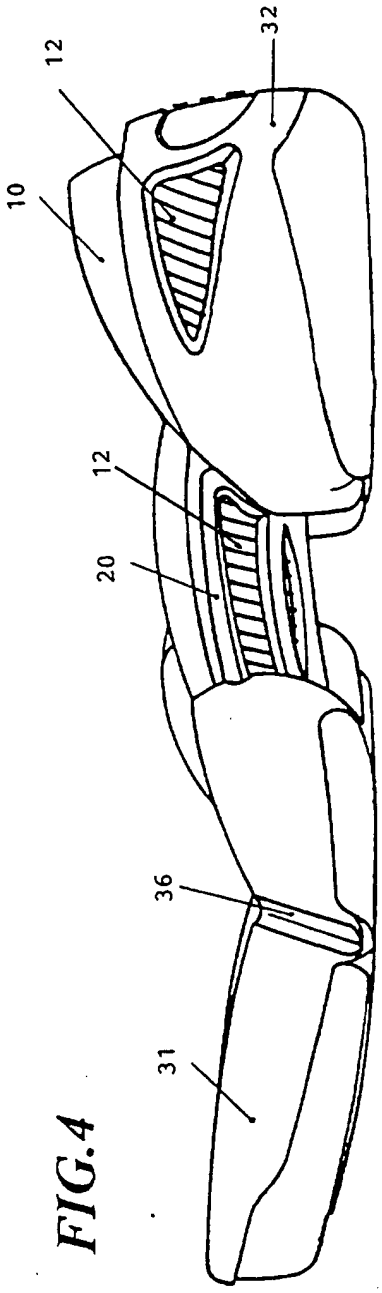


FIG.4

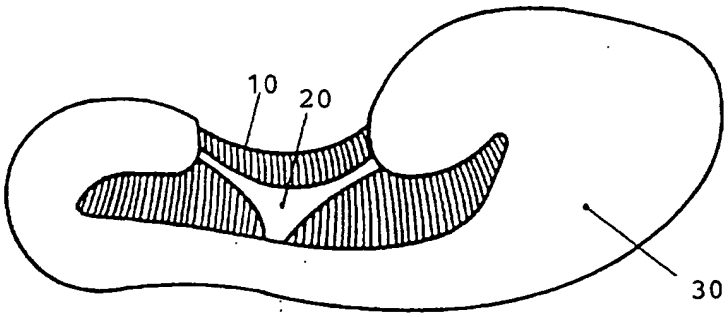


FIG.5

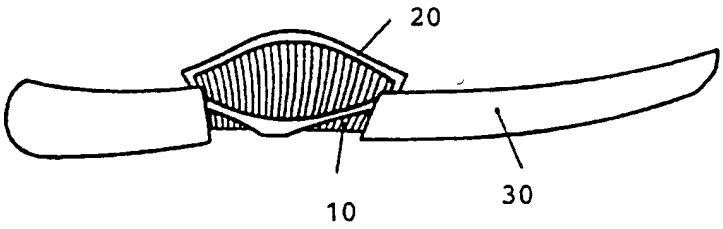


FIG.6

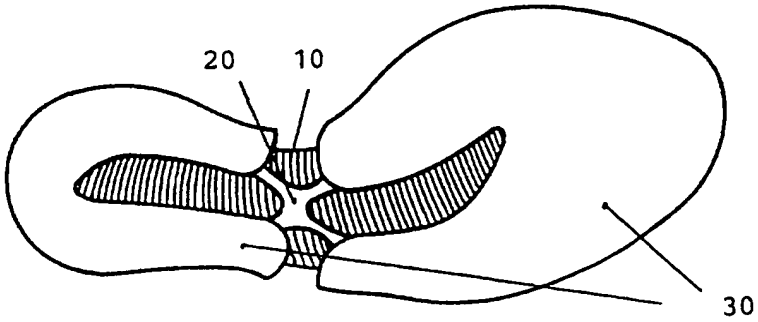


FIG.7

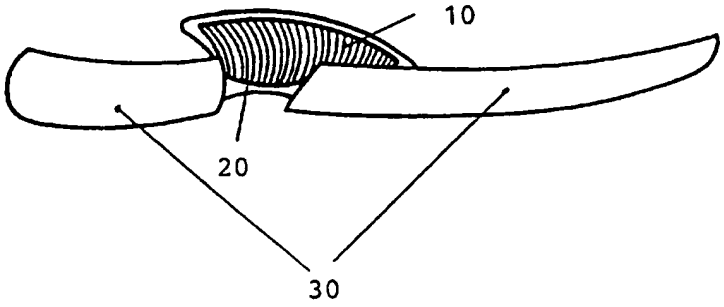


FIG.8

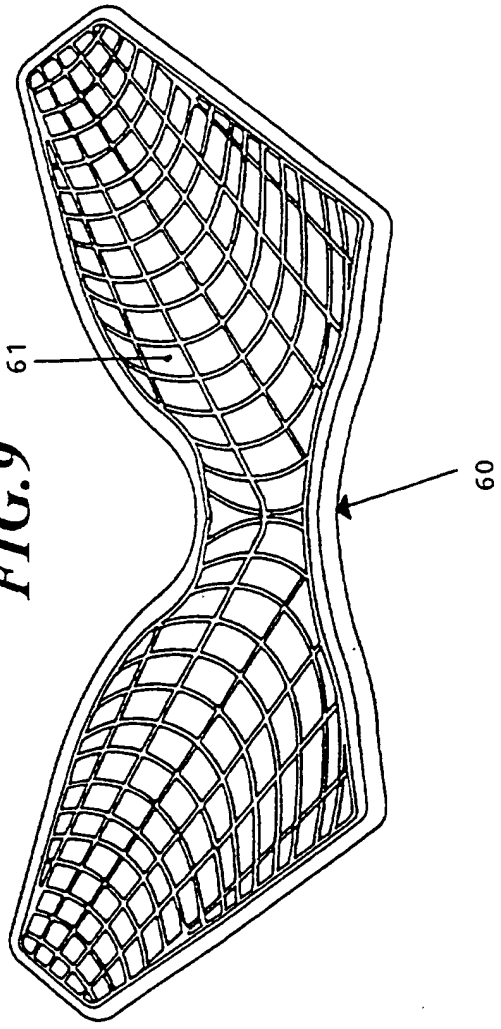


FIG.9

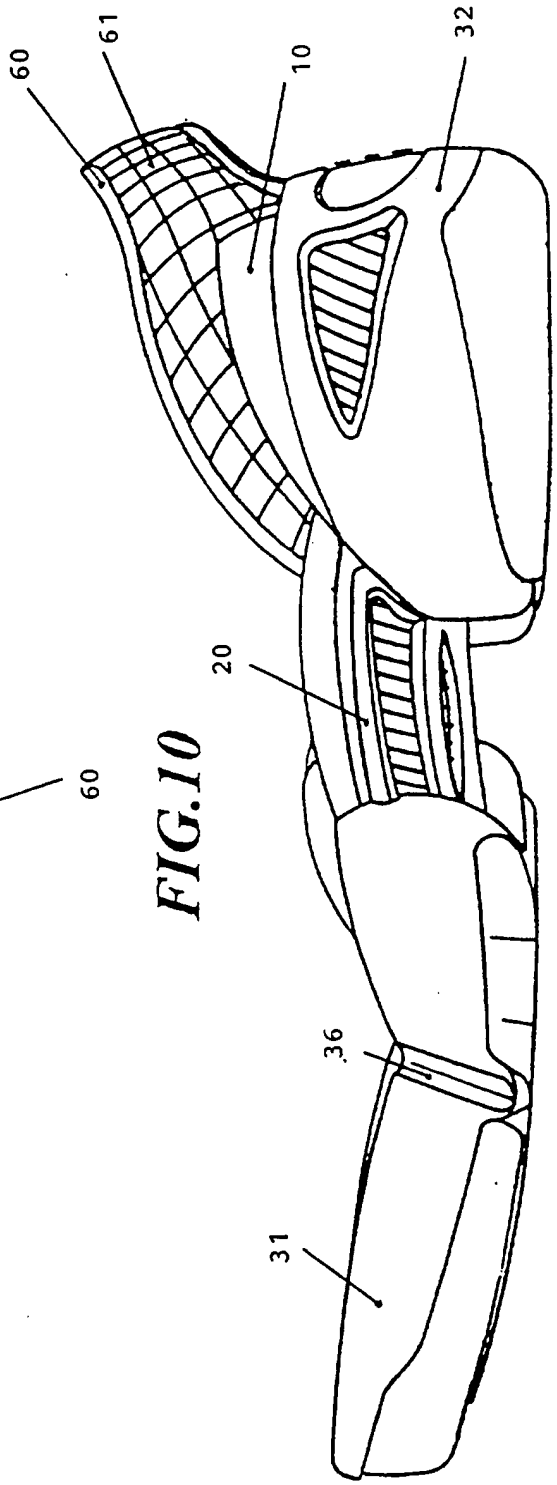


FIG.10

FIG. 11a

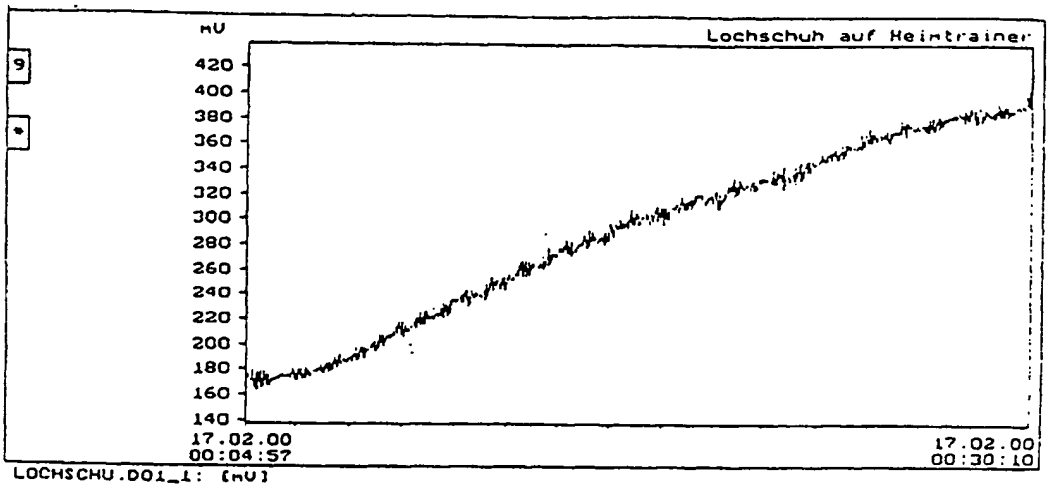
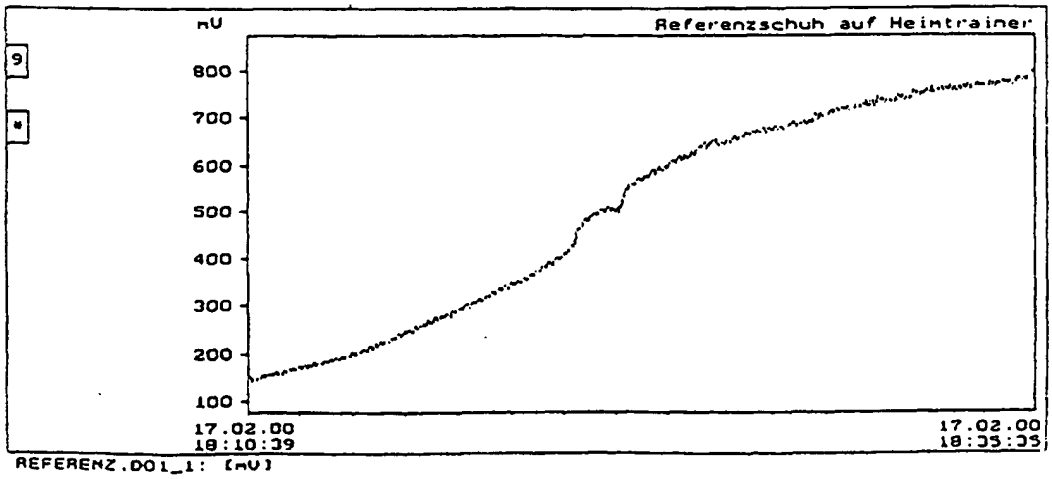


FIG. 11b



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EUROPEAN SEARCH REPORT

Application Number
EP 01 11 7622

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 November 2001	DECLERCK, J

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